



## FSM implementation in embedded memory blocks of programmable logic devices using functional decomposition

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### Abstract

Since modern programmable devices contain embedded memory blocks, there exists the possibility of implementing finite state machines (FSM) using such blocks. However, the size of the memory available in programmable devices is limited. The paper presents a general method for the synthesis of sequential circuits using embedded memory blocks. The method is based on the serial decomposition concept and relies on decomposing the memory block into two blocks: a combinational address modifier and a smaller memory block. An appropriately chosen decomposition strategy may allow reducing the required memory size at the cost of additional logic cells for address modifier implementation. This makes possible the implementation of FSMs that exceed available memory by using embedded memory blocks and additional programmable logic.

### Index Terms

#### Inspec

##### Controlled Indexing

finite state machines logic CAD programmable logic devices read-only storage sequential circuits

##### Non-controlled Indexing

combinational address modifier embedded memory blocks finite state machines functional decomposition logic cells memory size programmable logic devices sequential circuit synthesis serial decomposition

### Author Keywords

Not Available

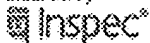
### References

No references available on IEEE Xplore.

### Citing Documents

No citing documents available on IEEEExplore.

Indexed by



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## EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L37	1	((((programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal) and ((memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5) near15 (((("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition))))).clm.	US-PGPUB	OR	ON	2006/12/23 14:10
L38	0	((((programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal) and ((memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5) near15 (((("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition)))) and (microprocessor or micro-processor or processor or cpu or mpu or multiprocessor or multi-processor or ((process\$3 or microprocess\$3 or micro-process\$3 or multiprocess\$3 or multi-process\$3) adj2 unit)) ).clm.	US-PGPUB	OR	ON	2006/12/23 14:10

Date Searched: 12/23/2006

Databases Searched: USPAT, USPGPUB

Plurals: ON

Terms Searched:

L1 (programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal  
L2 ("don't" adj care) or x or z) near5 (logic\$5 or set or value or boolean or state)  
L3 (memory or storage or ram or rom) same (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5)  
L4 2 same 3  
L5 microprocessor or micro-processor or processor or cpu or mpu or multiprocessor or multi-processor or ((process\$3 or microprocess\$3 or micro-process\$3 or multiprocess\$3 or multi-process\$3) adj2 unit)

L6 (memory or storage or ram or rom)

L7 5 same 6

L8 4 and 7

L9 8 and 1

Results: 673 hits

L10 716/1-18.ccls. or 713/1,2,100.ccls.

L11 9 and 10

Results: 36 hits

L12 ("don't" adj care)

L13 1 and (12 same 3) and 7 and 10

Results: 5 hits

L14 x or z

L15 1 and (14 same 3) and 7 and 10

Results: 125 hits

L16 (unused or un-used or ("not" adj2 use\$1) or available)

L17 1 and (16 same 3) and 7 and 10

Results: 582 hits

L18 1 and (16 same 7) and 10

Results: 425 hits

L19 18 and 3

Results: 416 hits

L20 1 and (16 same 7 same 3) and 10

Results: 249 hits

L21 (memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5)

L22 1 and (16 same 7 same 21) and 10

Results: 152 hits

L23 ("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition)

L24 21 same 23

L25 10 and 24

Results: 57 hits

MorfeY, Alistair et al. US 20050108662 A1

US-PGPUB 716/1

McCarten; David J. et al. US 6047127 A

USPAT 717/173

Killian; Earl A. et al. US 20060259878 A1

US-PGPUB 716/1

Killian, Earl A. et al. US 20030208723 A1

US-PGPUB 716/1

Westby; Judy Lynn US 6502189 B1

USPAT 713/1

Lesea; Austin H. et al.	US 6496971 B1	USPAT 716/16	
Lien; Jung-Cheun et al.	US 6446242 B1	USPAT 716/6	
Agrawal; Om P. et al.	US 7028281 B1	USPAT 716/12	
Chen; Ian et al.	US 5784291 A	USPAT 716/10	
Olsen; Glenn A. et al.	US 5189628 A	USPAT 716/7	
Yang, Pachinco	US 20040177240 A1	US-PGPUB	713/1
Rhoads, Edward R. et al.	US 20040158699 A1	US-PGPUB	713/1
May; Michael D. et al.	US 5452467 A	USPAT 716/1	

Databases Searched: EPO, JPO, IBM TDB, Derwent

Plurals: ON

Terms Searched:

L1 (programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal  
 L2 (memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5)  
 L3 ("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition)  
 L4 1 and (2 same 3)  
 Results: 3 hits

L5 (unused or un-used or ("not" adj2 use\$1) or available)

L6 1 and (2 same 5)

Results: 72 hits

MARSHALL, ALAN et al.	EP 858167 A1	EPO
MARSHALL, A et al.	US 6262908 B	DERWENT

Database Searched: IEE/IEEE XPlore

Terms Searched: ((programmable <near/3> (device or array)) or pld or cpld or pga or fpga or pal) and (memory or storage or ram or rom) <near/10> (configur\* or reconfig\* or re-config\* or initial\* or reinitial\* or re-initial\* or program\* or reprogram\* or re-program\*) and ("don't" <near/1> care) or x or z) <near/3> (logic\* or set or value or boolean or state or condition)

Results: Your search matched 0 documents.

Terms Searched: ((programmable <near/3> (device or array)) or pld or cpld or pga or fpga or pal) and (memory or storage or ram or rom) <near/10> (configur\* or reconfig\* or re-config\* or initial\* or reinitial\* or re-initial\* or program\* or reprogram\* or re-program\*) and (unused or un-used or ("not" <near/2> use\*) or available)

Results: Your search matched 180 of 1450046 documents

Terms Searched: ((programmable <near/3> (device or array)) or pld or cpld or pga or fpga or pal) and (memory or storage or ram or rom) <near/10> (configur\* or reconfig\* or re-config\* or initial\* or reinitial\* or re-initial\* or program\* or reprogram\* or re-program\*) <near/15> (unused or un-used or ("not" <near/2> use\*) or available)

Results: Your search matched 32 of 1450046 documents

**\*\*Interference Search\*\***

Database Searched: USPGPUB

Plurals: ON

Terms Searched:

L1 (((programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal) and ((memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5) near15 (((("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition))))).clm.

Results: 1 hit

L2 (((programmable adj3 (device or array)) or pld or cpld or pga or fpga or pal) and ((memory or storage or ram or rom) near10 (configur\$6 or reconfig\$6 or re-config\$6 or initial\$8 or reinitial\$8 or re-initial\$8 or program\$5 or reprogram\$5 or re-program\$5) near15 (((("don't" adj care) or x or z) near3 (logic\$5 or set or value or boolean or state or condition)))) and (microprocessor or micro-processor or processor or cpu or mpu or multiprocessor or multi-processor or ((process\$3 or microprocess\$3 or micro-process\$3 or multiprocess\$3 or multi-process\$3) adj2 unit)) ).clm.

Results: 0 hit